A REVIEW OF THE BIOLOGY AND CONSERVATION OF THE GREAT BLUE HERON *(Ardea herodias)* IN BRITISH COLUMBIA

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1.0 INTRODUCTION

The Great Blue Heron (*Ardea herodias*) breeds from southern Canada to Central America and on the Galapagos Islands (Butler 1992). In British Columbia these herons breed along the entire coast and in southern interior valleys at least as far north as 52°N (Fig. 1). Interior populations disperse in all directions for up to 3 months after breeding, before migrating south in autumn (Byrd 1978). Coastal populations in British Columbia disperse to nearby aquatic and upland habitats for the winter (Butler 1991, unpubl. band recovery data). Some local populations of Great Blue Herons have declined in North America (see review by Butler 1992) and the species is considered "sensitive and vulnerable" in British Columbia (B.C. Ministry of Environment 1990). Many colony-sites have been abandoned following disturbance by humans (Werschkul *et al.* 1976, Kelsall and Simpson 1979) and predators, especially the Bald Eagle (*Haliaeetus leucocephalus*; Norman *et al.* 1990). Contaminants might also reduce the nesting success of some herons (Elliott *et al.* 1989).

Management studies recommend "buffer zones" from human disturbance around colonies during the heron breeding season (e.g. Buckley and Buckley 1976, Parker 1980, Short and Cooper 1985, Koonz and Rakowski 1985, Vos *et al.* 1985). However, I know of no studies that have led to recommendations on protection of foraging and roost sites.

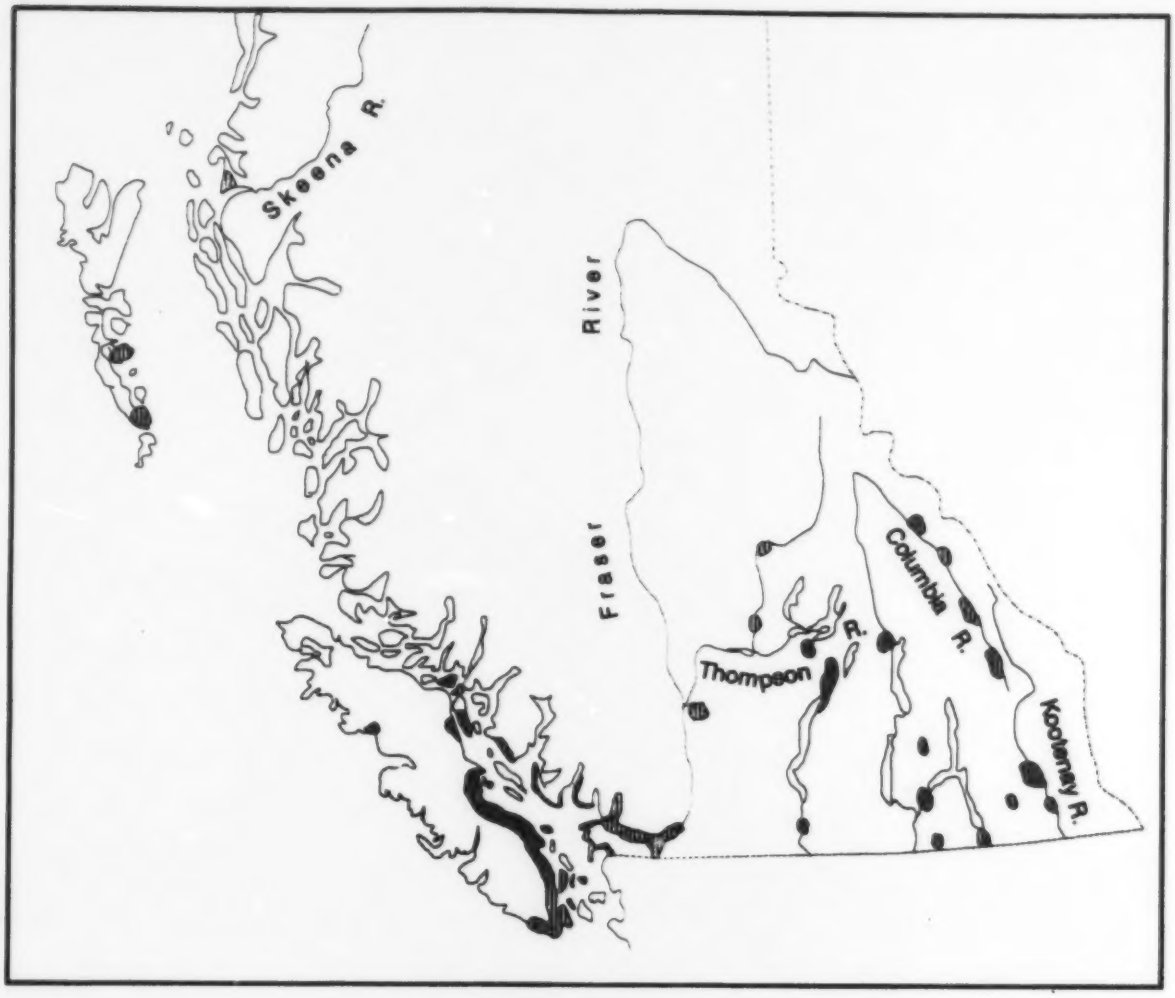

FIGURE 1. Breeding Locations of Great Blue Herons in British Columbia.

Sources are: Butler (1989), Campbell *et al.* (1990), L.S. Forbes (pers. comm.), R.W. Butler (unpubl. data).

Great Blue Heron in British Columbia and review conservation guidelines to protect heron colony-sites and foraging and roosting habitats.

2.0 THE BIOLOGY OF THE GREAT BLUE HERON

I define a *colony* as the group of herons that gather together to breed, *colony-site* as the location of their nests (Kushlan 1986), and *roost-site* as the location where one or more herons gather after feeding.

2.1 The Annual Cycle of the Great Blue Heron

Colony-sites - Most (68.5%, n=200 colony-sites) Great Blue Herons in B.C. nest in deciduous trees (Forbes *et al.* 1985). On the coast, herons nest most often in red alders (*Alnus rubra*)(73.2%; Butler 1989). The remainder nest in Douglas fir (*Pseudotsuga menziesii*, Sitka spruce (*Picea sitchensis*), big-leaf maple (*Acer macrophylla*), arbutus (*Arbutus menziesii*), western hemlock (*Tsuga heterophylla*), Garry oak (*Quercus garryana*) and western red cedar (*Thuja plicata*). East of the coast range most herons nest in cottonwoods (Forbes *et al.* 1985) but western white pine (*Pinus occidentalis*) and ponderosa pine (*P. ponderosa*) have also been used (Campbell *et al.* 1990).

Nests - Herons in British Columbia build nests in the canopies or on limbs of trees from 15 to 35m above ground with twigs from trees

near the colony-sites. I have occasionally seen herons fly to the ground to pick up twigs but most are broken from branches. Nests are about 1m wide by 30cm deep although there is much variation. The closest nests on Sidney Island were about 2m apart.

Courtship - Great Blue Herons on the coast gather on the ground, in trees within a few kilometers of colony-sites or fly directly into colony-sites in the evening. Herons on Sidney Island flew into the colony-site about 1900 h and stayed for 40 minutes on 17 March, 1988. By the 30 March many pairs of herons were present on nests. On 9 April they remained in the colony all day and night except when low tides exposed the beach foraging areas. The timing of events varies between colonies. Single herons were seen during the day for a month starting on 17 January 1991 at a colony-site in Stanley Park and pairs were seen one month later (Otter 1991).

Eggs - Female Great Blue Herons lay eggs at about 2 day intervals (Vermeer 1969). Complete clutches average about 4 eggs in British Columbia (Butler 1989) and are attended by the male and female (Moul 1990). The amount of time a heron incubated its eggs in a colony near the University of British Columbia ranged from about 1 to 7 hours (Paine 1972).

Nestlings - The eggs begin to hatch after an incubation time of about 28 days (Vermeer 1969). Hatching in heron eggs is asynchronous, so that the last-laid egg hatches after the first-

laid egg (Vermeer 1969). The asynchrony results in a size difference among the chicks. About 85% of eggs hatch in British Columbia nests.

Most eggs in a colony-site hatch within a 3 week period on the coast. The earliest colony hatches eggs nearly 3 weeks before the latest colony. Chicks are covered in pale-grey down and begin to call within minutes of hatching.

Foraging habitats and behaviour at the nest - Nesting females from coastal colonies feed close to the colony during the day (Butler 1991). Adult males guard or brood the nestlings through the period the female is away feeding. The male helps find food when the brood is about 3 weeks of age until the chicks leave the nest. Males fly up to 27 km from the colony to feed for the night (Butler 1991). They return to the nest in the morning to relieve their mates. There is no information on how far herons from interior colonies fly to forage. However, herons elsewhere in North America forage within about 5km of their colonies (Thomson 1978, Dowd and Flake 1985).

The female is largely responsible for feeding chicks less than 3 weeks old. On the coast, she catches mostly small fish, including shiner sea perch (*Cymatogaster aggregata*), three-spined sticklebacks (*Gasterosteus aculeatus*), gunnels (*Pholis* spp.), sculpins (*Leptocottus armatus*), eulachons (*Thaleichthys pacificus*) and flounders (*Platichthys stellatus*) to feed the chicks and herself (Butler 1991, Simpson 1984). Herons near one colony in the

interior ate black bullheads (*Ictalurus melas*), yellow perch (*Perca flavescens*), pumpkinseed sunfish (*Lepomis gibbosus*) and largemouth bass (*Micropterus salmoides*) (Forbes 1987).

The oldest, largest, chicks usually get the major share of food brought to the nest. The smallest chicks either starve or are pushed from the nest. This phenomenon explains why some young herons are found on the ground beneath nests.

Fledglings and juveniles - Heron chicks leave nests from late June to mid-August when they are about 60 days of age (Butler 1989). Fledglings become fully independent of their parents about 3 weeks after their inaugural flight from the nest although they continue to forage with the adults on beaches through the summer.

The Non-breeding Season

Food and foraging habitats - The heron has a catholic diet of mostly small aquatic animals. In a review of the diet of coastal herons, Verbeek and Butler (1989) listed 18 species of fish, 5 marine invertebrates and 2 small mammals. Forbes (1987) listed 4 species of fish and aquatic insects in the diet of herons near Creston in the interior of British Columbia. I have seen herons catch goldfish from garden pools and fish-farms and hatchery operators have reported herons catching trout (*Salmo* sp.) and salmon (*Onchorhynchos* sp.).

Juvenile herons are less efficient foragers than adults (Butler 1992). On the Fraser River delta, most juveniles cannot find enough

food on beaches by October and so many fly to grasslands to catch small mammals, especially the Townsend's Vole (*Microtus townsendii*). Adults continue to feed on the beaches until November when most move into the estuarine marshes. Adult males hold feeding territories along the banks of the Fraser River. Territorial males and females occur along the east coast of Vancouver Island (unpubl. data).

Little is known about yearling (12-24 mos. old) herons. They are found in estuaries throughout the year and are occasionally seen in the colonies (unpubl. data). Herons in the Fraser River delta gradually return to beaches to catch fish in late winter and feed there, nearly exclusively from March through October. They eat small fish caught on beaches when tides are low during night and day.

Less is known about foraging behaviour of herons in the interior of British Columbia outside of summer. Christmas Bird Counts indicate that a few stay through the winter along ice-free watercourses. Herons fight each other to the death for access to open water foraging sites in the ice (Forbes and McMackin 1984).

Roost-sites - Coastal herons roost close to their foraging sites during high tides. They form loose flocks on quiet beaches or settle in trees, on buildings and logs, in marshes, and in other exposed sites. Roost sites are abandoned on windy days for the shelter of bushes, fences and trees usually within 400m. Coastal

herons roost off the ground in trees at night when tides are high. It is unknown where interior populations roost.

3.0 CONSERVATION OF GREAT BLUE HERONS

The conservation of heron populations in British Columbia requires maintaining shallow beaches, marshes and coastal grasslands where herons forage and quiet tracts of forest for nesting.

3.1 Foraging habitats

Many studies have shown that the size of breeding populations of herons is positively related to the available area of wetland foraging habitat (Werschkul *et al.* 1978, Parker 1980, Gibbs *et al.* 1987). Butler (1991) showed that coastal breeding herons in British Columbia fed in estuarine marshes and shallow beaches, especially those with eelgrass (*Zostera marina*) beds. Many juvenile and some adult herons in the Fraser River delta feed on small mammals, especially *Microtus townsendii*, found in grasslands in autumn and winter. Heron populations in the interior and coastal valleys depend on shallow marshes along rivers and lakes in the southern half of the province. Therefore, heron conservation depends on maintaining prey populations on shallow beaches, in marshes and Fraser River delta grasslands near beaches.

3.2 Colony-sites

Forbes *et al.* (1985) located historical records of 85 colony-sites along the coast and 26 colony-sites in the interior of B.C. Eleven (40.7%) of 27 colony-sites reported to be in use by Forbes *et al.* (1985) in 1979-81 were still in use in 1987 (Butler 1989). Many colonies have relocated between 1987 and 1991 (unpubl. data) suggesting that some coastal herons are mobile. However, some colony-sites have been used for decades (Butler 1989).

Herons nest near their foraging habitats (Butler 1991, Gibbs *et al.* 1987). A sample of 22 coastal colonies were located an average of 2.3 km (maximum of 6 km) from the main foraging site (Butler 1991).

The effects of human disturbance on nesting herons depends on the stage of the nesting cycle, degree of habituation to disturbance, and nature of the disturbance. Herons abandon colony-sites most often before their eggs hatch (Parker 1980, unpubl. data). Large colonies will splinter into several smaller colonies following abandonment of a colony-site (Parker 1980).

Some herons in British Columbia have habituated to nearby activities that are non-threatening. A colony of about 30 pairs has nested in Stanley Park since 1921 and moved into the busy zoo area in the early 1970s. Other colonies in British Columbia have established beside an industrial site near Parksville, in Beacon Hill and Tillicum parks near Victoria and beside a large hotel in Richmond (Webb and Forbes 1982). One pair raised young in a nest in a tree along a suburban street in Vancouver. Parker (1980)

hypothesized that herons in Montana were least likely to abandon colony-sites near productive feeding areas. The relative biological productivity of feeding sites in British Columbia is unknown.

Studies have implicated logging activity (Werschkul *et al.* 1976), house construction (Kelsall and Simpson 1979) and recreation activities (Parker 1980, Vos *et al.* 1985) in causing colony-site abandonments. Human disturbance is exacerbated by Bald Eagle predation in coastal colonies in British Columbia (Norman *et al.* 1990). Butler (1991) reported eagle attacks at 16 out of 44 colony-sites around the Strait of Georgia and witnessed the abandonment of a colony on Sidney Island following the death of several adult herons by eagles. However, he was unable to find any indication that herons avoided nesting in areas where eagles nested in high densities.

All authors on heron colony management recommend buffer zones around colony-sites. Although colonies respond differently to disturbances, buffer zones are the only way to ensure against abandonment. From a review of 10 heron studies, Kelsall (pers. comm.) concluded that most authors recommended a minimum of a 300m buffer zone from the periphery of the colony-sites. In that zone there should be no activity during courtship and nesting with the exception of controlled scientific studies. Moreover, no heavy development such as logging or construction should occur within 1000m of a colony-site and no aircraft should fly within a vertical distance of 650m during the nesting season.

The distance at which herons began to fly from colony-sites in British Columbia varied greatly between nine colonies around the Strait of Georgia in 1991 (Figure 2). Herons at the most sensitive colony-site near Quamichan Lake flew from nests when I approached within 200m of the colony a few days before they laid eggs. After eggs were laid one could approach within about 100m of the colony before herons left their nests and within about 25m once they hatched their eggs. One could approach within 10m of the colony before herons flew from nests with chicks (Figure 2). These results suggest that a 300m buffer zone in which no access is permitted from February to late August will adequately prevent abandonments of British Columbia colony-sites by humans on foot. There are no data on the sensitivity of nesting herons to loud noises such as heavy construction, logging and house construction. Bowman and Siderius (1984) recommend a 1000m buffer zone which excludes highly disturbing activities such as logging, pipeline construction and forest site preparation during the nesting season.

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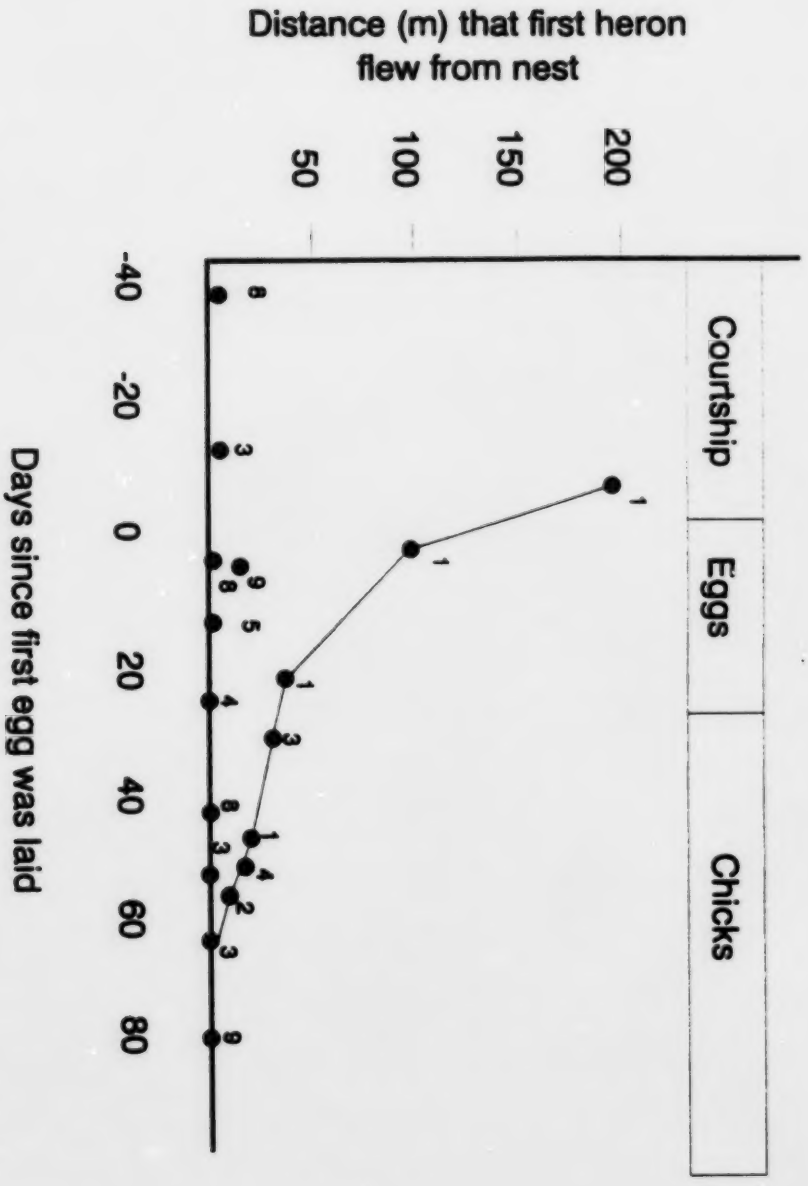

Figure 2. Distance at which breeding herons at nine colonies first flew from nests when approached by a human on foot. Numbers correspond to colony-sites, day zero refers to the day that eggs began to hatch at each colony-site and the solid line connects the most easily disturbed colony-sites.

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